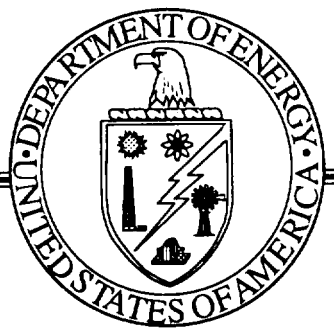
APPENDIX D

FIELD VERIFICATION REPORT
LAWRENCE LIVERMORE NATIONAL LABORATORY
APRIL 18-26, 1994



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EXECUTIVE SUMMARY

This report presents the results of the field verification review conducted at Lawrence Livermore National Laboratory (LLNL) from April 18 to April 26, 1994. The LLNL review was part of the Chemical Safety Vulnerability Review being conducted by the Department of Energy's Office of Environment, Safety and Health at the direction of the Secretary of Energy. The purpose of the review is to identify and characterize conditions or circumstances involving potentially hazardous chemicals at DOE facilities. Specifically, the review is designed to identify, characterize, and prioritize chemical safety vulnerabilities that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

Ongoing activities at LLNL include the varied use, handling, transportation, storage, and disposal of hazardous chemicals primarily related to laboratory processes. During the field verification review, team members reviewed those facilities included in the LLNL self-evaluation effort (i.e., the B-222-229 Complex, B-235, and the B-825-827 Complex). In addition, B-1 53, B-322, and the City of Livermore Fire Station No, 2 were visited by the review team.

As a result of the LLNL field verification activities, four chemical vulnerabilities were identified: (1) limited strategic planning for the disposition of aging/inactive facilities that may contain residual amounts of hazardous or mixed waste, (2) weaknesses in the hazards analysis program, (3) the absence of Emergency Plan Implementing Procedures for integrated LLNL response to a sitewide hazardous materials emergency, and (4) personnel entry into potentially hazardous work environments without benefit of chemical safety training. The vulnerability pertaining to disposition of aging/inactive facilities that may contain residual amounts of hazardous or mixed waste is identified as both an LLNL site-specific vulnerability and a potential DOE-wide generic chemical vulnerability. This vulnerability is related to the problematic issue of aging, deteriorating buildings identified in the LLNL self-evaluation. The vulnerabilities pertaining to hazards analysis, emergency response, and implementation of chemical safety training are identified as site-specific vulnerabilities associated with sitewide LLNL programs, These vulnerabilities are related to the management prioritization and resource allocation concerns identified in the LLNL self-evaluation. None of the identified vulnerabilities represents a condition or circumstance with severe potential consequences in the near term.

Field verification activities also identified the following commendable practices pertaining to chemical safety at LLNL: (1) use of a dedicated hazardous waste management technician to manage wastes generated by Chemistry and Materials Science Directorate researchers, (2) development of a system to calculate and classify air emissions to facilitate compliance with California air regulations, (3) development and implementation of a Laboratory-wide form to enhance the identification of potential hazards in the workplace, (4) formation by maintenance personnel of an independent safety committee to promote safe work practices, (5) development and (future) implementation of the ChemTrack and Facility Management Information Systems to provide information on chemical inventories, (6) provision of support to the Albuquerque Operations Office Toxic Materials Coordinating Committee, and (7) coordination of emergency response between the LLNL Fire Department and the fire departments of surrounding communities.

The vulnerabilities identified at LLNL, along with those identified at other DOE sites during the field verification phase of the Chemical Safety Vulnerability Review, will be evaluated to determine DOE-wide generic vulnerabilities. Site-specific vulnerabilities are being made available to the sites for use in developing management response plans, which in turn will provide input for the DOE-wide management response plan.

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities within the Department of Energy (DOE). The Office of Environment, Safety and Health was designated to lead the review, with full participation from DOE line organizations having operational responsibilities. The information obtained from the review will provide the Working Group with valuable input for determining generic chemical safety vulnerabilities that face the DOE complex. Identifying and prioritizing generic chemical safety vulnerabilities will enhance the Department's focus on programs, funding, and policy decisions related to chemical safety.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review was designed to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. Using input from line organizations with operational responsibilities, to guide the review, the Working Group developed a project plan[i] to guide the review.

This report documents activities related to the field verification phase of the Chemical Safety Vulnerability Review. The field verification process was designed to use independent teams of technical professionals with experience in a variety of environment, safety, and health (ES&H) disciplines to verify the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. The field self-evaluation phase of the review used a standardized question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities located at 29 sites. Based on review of this input, nine sites, including Lawrence Livermore National Laboratory (LLNL), were chosen to participate in the field verification phase of the review.

The review considered a broad range of facilities at LLNL (based on facility type and operational status), with special attention given to those facilities being transferred to, awaiting, or undergoing decontamination and decommissioning (D&D). Different types of chemical- and waste-handling facilities, including laboratories, process facilities, and waste treatment and storage facilities, were examined during the review to permit identification of vulnerabilities arising from hazardous chemicals and wastes at LLNL.

The LLNL field verification team, under the direction of a DOE team leader, was composed of DOE staff and contractor personnel with technical expertise in various aspects of chemical safety, including management, operations, training, chemical process safety, industrial

[i] "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994.

hygiene, maintenance, environmental protection, and emergency preparedness. A team composition list is provided in Attachment 1 of this appendix.

The team met with management or technical representatives from each of the facilities reviewed. Individual and small group meetings were also held, and team members conducted facility walkthroughs, document reviews, and personnel interviews to gather information related to potential chemical safety vulnerabilities at LLNL. The team leader met daily with management personnel to discuss the team's activities and any issues that may have surfaced during the previous day. Before the field verification team left the LLNL site, management from local DOE and contractor organizations conducted a factual accuracy review of the draft document. An outbriefing was conducted for DOE and contractor management on Tuesday, April 26, 1994. A draft copy of this report was provided to DOE and contractor management.

1.2 **Site Description**

LLNL is located on an 821-acre site at the eastern end of Livermore Valley in southeastern Alameda County, California, about 50 miles southeast of San Francisco. Figure 1 shows the regional location of LLN L. The Livermore Valley is the eastern part of a valley system lying south of Mt. Diablo and east of the hills surrounding San Francisco Bay. Farther to the east, another low range of hills separates the Livermore Valley from the San Joaquin Valley of central California; to the north rise the higher hills of the Diablo Range, a sparsely settled region of forest, chaparral, and rangeland. The hills around the Livermore Valley are for the most part covered with grasses. Agriculture remains the major land use east of LLNL, but land to the north is being developed for light industrial uses. Similarly, to the west, land once used for agricultural purposes is being developed because of increased land sales, creation of subdivisions, and annexations by the city of Livermore. On its southern perimeter, LLNL shares East Avenue with Sandia National Laboratory, with which it also shares fire protection functions, a cafeteria, parking lots, and utilities. Figure 2 shows a site plan of the LLNL main site.

Site 300, which is considered part of LLNL, comprises 11 square miles, and is located in both Alameda and San Joaquin Counties, about 18 miles east of the LLNL main site. Site 300 was established as a remote explosives facility to support theoretical and developmental work performed at the LLNL main site. Site 300 is used primarily for performing high explosive tests, although assembly testing is also conducted there. Portions of Site 300 used to support these activities include the firing and test areas, chemistry and process areas, and the general administration and support areas. The area surrounding Site 300 is sparsely populated, with most of the land used to support sheep and cattle ranching. Figure 3 provides a plan of Site 300.

LLNL is operated by the University of California (UC) under contract to DOE. Founded as a nuclear weapons design laboratory in 1952, it was officially established as Lawrence Radiation Laboratory, the nation's second laboratory dedicated to nuclear weapons research and development. LLNL has been operated by UC ever since, for the Atomic Energy Commission (AEC) until 1975, for the Energy Research and Development Administration (ERDA) until 1977, and now for DOE. LLNL is a multiprogram, mission-oriented institution engaged in theoretical and applied research programs requiring a multidisciplinary approach.

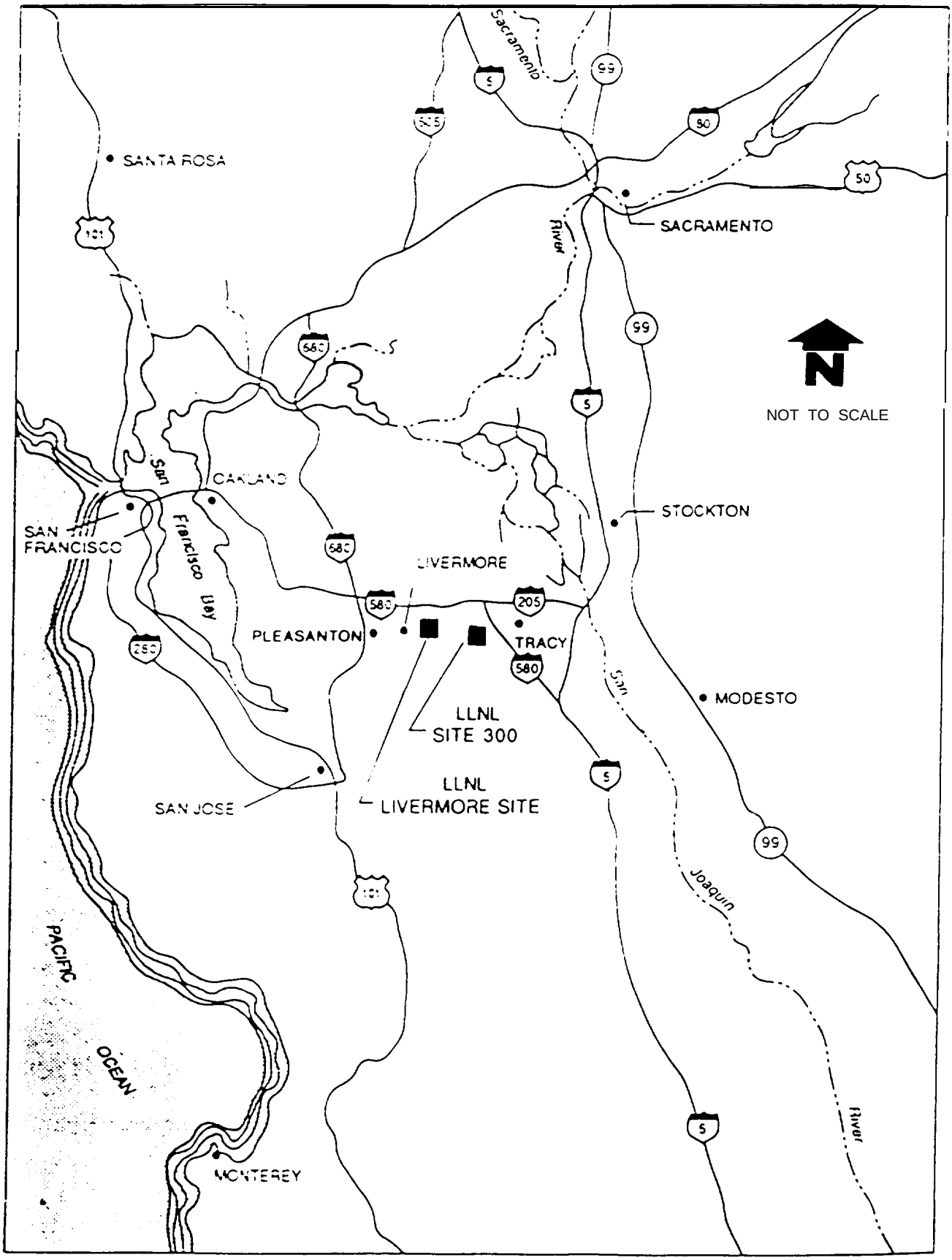

FIGURE 1. LLNL Location

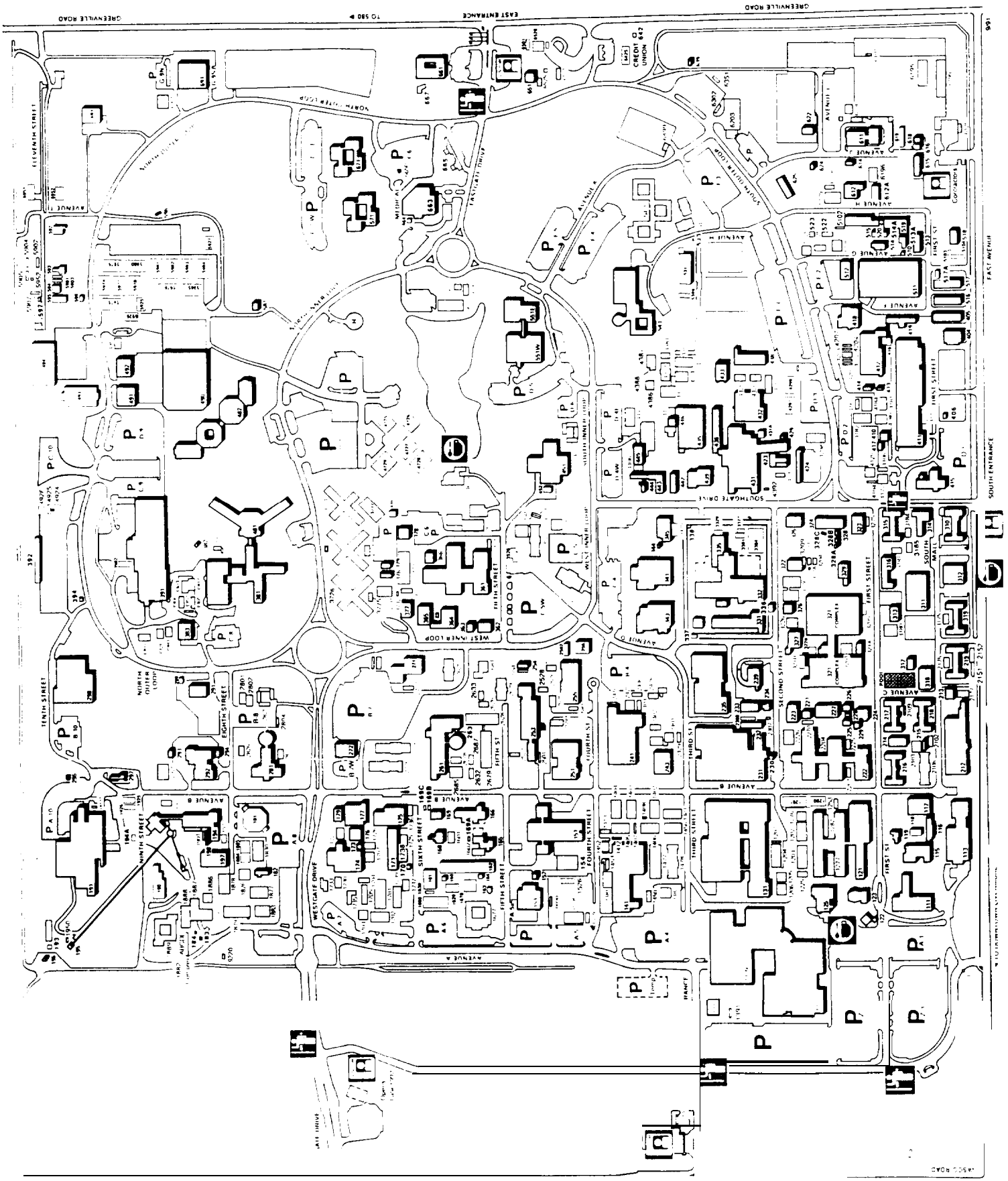

FIGURE 2. LLNL Main Site

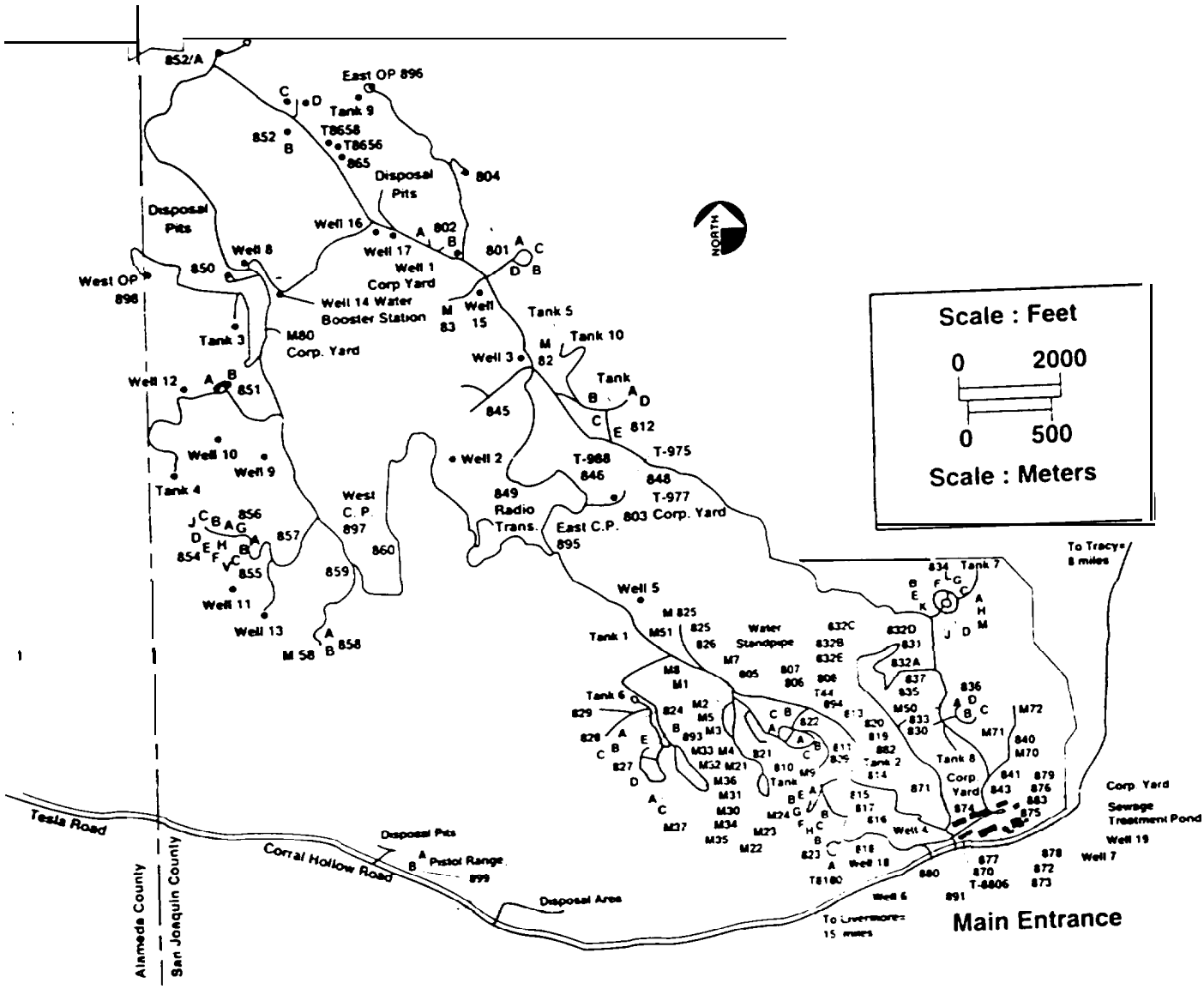

FIGURE 3. LLNL Site 300

Major programs at LLNL include research, development, and test activities associated with the nuclear design aspects of the nuclear weapons life cycle and related national security tasks; inertial confinement fusion; magnetic fusion energy; biomedical and environmental research; laser isotope separation; energy-related research; beam research physics; and support to a variety of the Department of Defense and other Federal agencies. Site 300 provides the ability to develop new high explosives or fabricate high explosives from raw materials, the ability to manufacture and assemble parts for testing, test facilities for destructive and nondestructive testing, support for projects using high explosives, diagnostics, and the capability to perform particle beam research.

1.3 **Facilities Visited**

Visiting every DOE facility at LLNL was not possible under the time constraints of this review. As a result, the field verification team focused its efforts to achieve the maximum results possible in the time available. Operations selected for field review focused on research and laboratory activities performed in facilities managed by LLNL's Chemistry and Materials Science (C&MS) Directorate, including Buildings 222-229, referred to as the B-222-229 Complex; Building 235; and Buildings 825, 826, and 827 A-E, referred to as the B-825-827 Complex. Building 153 (the Electronics Engineering Microfabrication Facility), Building 322 (the Metals Finishing Facility), and the City of Livermore Fire Station No. 2 were also examined.

The B-222-229 Complex consists primarily of operating laboratories for a variety of research projects and chemical analysis activities. Only B-225 is temporarily inactive and is undergoing renovation for conversion to general laboratory space. For each building reviewed, the current or most recent mission, a brief description, and the square footage are provided in Table 1.

Table 1. Profile of B-222-229 Complex

BLDG NO.	MISSION	DESCRIPTION	SIZE (SQ FT)
B-222	Laboratoy	Contains 75 laboratories, 97 offices, I conference room, and 4 bathrooms.	64,524
B-223	Machinery and general industry	Contains six offices, three shops, one mechanical equipment room, and two bathrooms,	5,855
B-224	Laboratory	Contains nine support laboratories, three offices, two mechanical equipment rooms, and one bathroom.	4,003
B-225	Process facility, vacant at this time	Contains two industrial shops, four chemistry laboratories, one mechanical equipment room, and one office.	1,515
B-226	Laboratory	Contains six chemistry laboratories and one mechanical equipment room.	1,219
B-227	Laboratory	Contains 15 chemistry laboratories, 1 mechanical equipment room, 9 offices, and 2 bathrooms.	8,640
B-228	Waste storage facility or site	Consists of one large room with a center divider.	166
B-229	Chemical storage facility or warehouse	Consists of one large room with a center divider.	637

Building 235 contains laboratories and administrative offices and is 97,979 square feet in size. The building consists of three levels; the basement level contains several mechanical utility rooms, partitioned areas used for programmatic storage, a service machine shop, and two laboratories. The first floor houses 42 research and development laboratories and 73 offices, 4 mechanical utility rooms, 2 copy rooms, 1 lunchroom, 2 conference rooms, and 4 bathrooms. The second floor houses 66 offices, 2 copy rooms, 3 conference rooms, 2 bathrooms, 2 rooms used for storage (1 of which is used for secured storage), 3 mechanical equipment rooms, and 1 janitorial storage room.

The B-825-827 Complex consists of research laboratories used for processing energetic materials and components. One section of this Complex (i.e., B-827, Area D-2) is used occasionally to develop prototype explosive materials using pilot-plant scale equipment. For each building reviewed, the current or most recent mission, a brief description, and the square footage are provided in Table 2.

Table 2. Profile of B-825-827 Complex

BLDG NO.	MISSION	DESCRIPTION	SIZE (SQ F-r)
B-825	Process facility	An explosive processing facility that consists of two remote processing cells, a mechanical equipment room, and an office/control room that includes a bathroom.	1,224
B-826	Process facility	An explosive processing facility that consists of two remote processing cells, a mechanical equipment room, and an office/control room that includes a bathroom.	1,742
B-827A	Process facility	Consists of a basement where the mechanical equipment room and a large inert storage room are located; the first floor contains a research and development explosive processing laboratory, three offices, a remote control room, and a change room/bathroom.	4,264
B-8276	Machinery and general industry	Consists of two rooms; one room is used for a conventional machine shop, and the second **room is** used to perform small-scale inert assembly work and to provide an office area for the supporting machinist.	861
B-827C	Process facility	An explosive processing facility that consists of two remote processing cells, a mechanical equipment room, an **inert storage room, and a service magazine.** The top and both ends are covered with earth. The building front is constructed such that if an unplanned event were to occur, overpressure would be vented through the doors and frangible walls.	3,509
B-827D	Process facility	An explosive processing facility that consists of two remote processing cells, a mechanical equipment room, an inert storage room, and a service magazine. The top and both ends are covered with earth. The building front is constructed such that if an unplanned event were to occur, overpressure would be vented through the doors and frangible walls.	3,509
B-827E	Process facility	An explosive processing facility that consists of two remote processing cells, a mechanical equipment room, an inert storage room, and a service magazine. The top and both ends are covered with earth. The building front is constructed such that if an unplanned event were to occur, overpressure would be vented through the doors and frangible walls.	3,509

2.0 SUMMARY OF RESULTS

The field verification process was designed to verify the accuracy and completeness of the data provided by LLNL in its field self-evaluation. The verification process also offered an opportunity to scrutinize Laboratory practices and thereby to identify potential chemical safety vulnerabilities. This process enabled informed judgments to be made about the seriousness of these conditions and development of a prioritized list of chemical safety vulnerabilities at selected LLNL facilities. In addition, this process will assist in subsequent determination of DOE-wide chemical safety vulnerabilities.

During the onsite portion of the review, team members visited the facilities that participated in the self-evaluation effort (i.e., the B-222-229 Complex, B-235, and the B-825-827 Complex) to verify reported observations and to look for other conditions and circumstances that could result in chemical safety vulnerabilities. Specifically, the review included an assessment of chemical management procedures; identification of properties (e.g., corrosive, reactive, toxic, carcinogenic, energetic) of hazardous materials; examination of human resource programs; facility walkthroughs; interviews with staff from the C&MS Directorate, the Plant Operations Directorate (including the staff from the Hazards Control Department and the Environmental Protection Department), the Engineering Directorate, and the Emergency Preparedness Response Program; and an evaluation of the applicable safety documentation (e.g., operating procedures).

Three facilities that were not involved in the original LLNL self-evaluation were also visited and have provided valuable information for the review. These included B-1 53 (the Electronics Engineering Microfabrication Facility), B-322 (the Metals Finishing Facility), and city of Livermore Fire Station No. 2.

The field verification review was organized to include five functional areas:

- Identification of chemical holdings, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.

- Facility physical condition, including engineered barriers, maintenance conditions, the chemical systems, safety systems, storage, monitoring systems, and hazards identification.

- Operational control and management systems, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.

- Human resource programs, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor control.

- Emergency management program, including the emergency response plan, inplant consequences, environmental issues, coordination with the community, and community right-to-know issues.

Summaries of these functional areas are provided in the sections below.

2.1 **Identification of Chemical Holdings**

The LLNL self-evaluation provides a summary of the status of chemical holdings, primarily located in reviewed buildings under the C&MS Directorate, and controls implemented to reduce or eliminate potential employee exposures and releases to the environment. Overall, sitewide progress has been made toward enhancing hazardous chemical control programs since the July 1992 Chemical Safety Oversight Review,

Hazardous chemical inventories in the LLNL buildings reviewed are in laboratory-scale quantities that are less than 25 percent of the threshold quantities identified in 29 CFR 1910.119 and 40 CFR 68. Limited verification was made of previously identified threshold quantities of chemical holdings in B-322. Although a range of potentially hazardous chemicals, including carcinogens and energetic materials, are routinely used in the different buildings, control measures have been implemented to mitigate personal exposures and generation of significant quantities of hazardous wastes.

A comprehensive, online, computerized, Laboratory-wide chemical tracking system (ChemTrack) and a material safety data sheet system are in the initial stages of implementation at LLNL. Bar-code labeling will make possible the tracking of current chemical purchases and existing individual chemical containers throughout the Laboratory (see Section 2.3). ChemTrack will facilitate compliance with regulatory requirements, including 40 CFR 370, “Community Right-to-Know,” and Executive Order 12856, “Toxic Material Release Inventory Reporting Program.” The Chemical Exchange Warehouse (CHEW) is an example of another LLNL program currently being implemented to enhance use and control of chemicals and to reduce quantities of hazardous wastes, The CHEW allows for the reapplication of excess chemicals in lieu of classification as hazardous wastes.

Hazardous waste inventories for the buildings are managed in accordance with State of California Waste Management Regulations under delegated authority from the U.S. Environmental Protection Agency. Containers of hazardous chemicals are stored in a manner that prevents or minimizes the potential for inadvertent releases of contained materials. Waste generators maintain satellite accumulation areas at each generation site. These generators receive annual training in hazardous waste generation and certification.

Procedures have been implemented within the C&MS Directorate to assist in proper labeling and container management and to ensure that all wastes are characterized and sent to the treatment, storage, and disposal (TSD) facility within the allowable accumulation time. The C&MS Directorate uses the full-time services of a Hazardous Waste Management Technician to be responsible for and manage hazardous waste generated within the C&MS Directorate, thus freeing researchers from routine hazardous waste management requirements. Generators of hazardous waste retain ultimate responsibility for waste generated in a given

location. The practice of using a designated staff member for the implementation of the hazardous waste control program is commendable.

A complete historical inventoty of chemical residuals has not been developed for the individual buildings reviewed. However, necessary documentation is available to facilitate characterization of the potential hazards associated with residuals. LLNL has an informal procedure to facilitate the determination of whether there are chemical residues in areas such as inactive piping, vents, and tanks. Examples of suspected residual chemicals include perchlorates and uranium residues in exhaust ductwork, mercury in some drain lines, and explosives dusts in ventilation ducts. During a recent renovation of laboratory space, samples of both potential radioactive and chemical residues from pipes and ducting were collected by a staff member. Approval will be given to the building manager to remove the ducting only after satisfactory characterization and remediation of the duct contents.

Operating exhaust stacks, vents, and sources of fugitive emissions are inventoried yearly during air quality compliance self-assessments. A commendable system to calculate and classify potential air emissions has been developed at LLNL. The system, the Emissions Measurements and Information Tracking System, is in use at LLNL to classify and perform calculations on about 650 air emission sources. A patent application has been filed on this unique system.

About 98 percent of the water discharges at LLNL have been identified, inventoried, and evaluated to determine the need for mitigation controls. The remaining water discharges have proven difficult to characterize given operational and security considerations.

Routine measurements are performed on both hazardous and mixed wastes by personnel assigned to the LLNL Environmental Analytical Sciences (EAS) Laboratory. Samples are collected and sent to the Laboratory by trained EAS Laboratory sampling personnel. As an added precaution against improper waste characterization, and as a quality assurance check, about 10 to 15 percent of all wastes are randomly selected (at the onsite interim status storage facility) for recharacterization. Materials determined to have no associated radioactive component can then be shipped to offsite TSD facilities.

Industrial hygiene technical support for operations in C&MS Directorate locations is provided by personnel from ES&H Team 3 at the main site and ES&H Team 1 at Site 300. The Technical Leader for Industrial Hygiene, from the Technical Policies and Procedures Division of the Hazards Control Department, monitors the field program to ensure consistent implementation of the program throughout LLNL. Specific industrial hygiene support activities include (1) review of operational safety procedures (OSPS) and facility safety procedures (FSPS); (2) completion of special hazards assessment forms to address health concerns with special procedures or processes; (3) review of project work plans (i.e., documents describing new work and major changes to existing work); and (4) support for the release of excess equipment and chemical agents.

The Hazards Control Department industrial hygiene staff has developed a new form to facilitate characterization of workplace hazards. The Hazards Assessment and Control Form was developed as an integral part of the Sample Tracking and Reporting Program to enhance the ongoing conduct and documentation of hazards and to comply with current and proposed

DOE requirements. This form is a commendable practice because it provides ineffective means of hazards identification by including the technical perspective of the Hazards Control Department and direct contact with the employee in the workplace. Completion of the Hazards Assessment and Control Form enhances existing procedures (see Section 2.4) and facilitates identification of potential occupational exposures and subsequent implementation of necessary workplace controls. Hazards assessment data provide information to operations personnel and the medical department. Full implementation of the revised hazards assessment process using the new form is expected to be completed by the end of the current calendar year.

2.2 **Facility Physical Condition**

Generally, the conditions of the B-222-229 Complex, B-235, and the B-825-827 Complex were observed to be as described in the LLNL self-evaluation. All facilities were in fair to good condition, with the exception of B-222, which was classified by the Laboratory as being in poor condition. Of all the facilities examined, Building 222 presents the greatest maintenance management challenge. A large maintenance backlog exists, and conduct of maintenance is difficult due in part to a leaking roof and the deteriorating condition of much of the mechanical equipment on the roof. For safety and health considerations, maintenance activities must include implementation of a series of administrative controls, such as roof access permits, and must be coordinated with laboratory scientists (who must shut down experiments in chemical fume hoods) to reduce the potential for maintenance personnel injury or uptake of chemical fumes emanating from the multiple fume hood ventilation systems.

Building 222 is **40** years old and is scheduled for transition to D&D within the next 5 years. A conceptual design review, which examines and estimates the cost of various options, has been partially completed for this building. The recommended option described in this review is to vacate the building in late 1995 and to commence building demolition. Planning activities are under way and adequate for this stage of the moving process. Planning for relocation of building occupants to other facilities and for waste characterization activities is not complete.

A relatively large quantity of the toxic chemical beryllium hydride is stored in B-229, a concrete building with a wood-tar-asphalt sheet roof. The beryllium hydride is stored in glass or plastic bottles inside bags with steel overpacks. A roof fire could result in dispersal of the beryllium hydride. A preliminary hazards analysis is under way for this facility (currently classified as low hazard, nonnuclear) to evaluate the potential risk associated with a fire.

Maintenance programs are in place to control work activities. Providing a safe working environment requires the cooperative efforts of both maintenance and Hazards Control Department personnel. Maintenance personnel have formed an independent safety committee to promote safe work practices. The activities of this committee resulted in implementation of a commendable roof access control system that has been recognized as instrumental in improving work safety, especially for activities at B-222. The B-222 staff worked closely with the maintenance department to establish the above-noted safe work practice.

One vulnerability related to the uncertainty of the final disposition of aging or inactive facilities was identified. An example is B-222, which has excessive maintenance costs and has

reached the end of useful life. A more detailed discussion of this vulnerability is provided in Section 3.2 and in Attachment 2 of this appendix.

2.3 **Operational Control and Management Systems**

LLNL management has established systems that currently ensure the chemical safety of operations to an acceptable degree. The Laboratory is organized by directorates. Each directorate has an Assurance Office, headed by an Assurance Manager who reports directly to the Associate Director, for providing assurance that elements are in place to maintain adequate safety in each organizational unit.

A major part of this review concentrated on the chemical safety program in the C&MS Directorate, because all the facilities examined in the LLNL self-evaluation are under the auspices of this organization. However, discussions with the Associate Director of the Plant Operations Directorate and the Deputy Department Head of the Hazards Control Department indicated that analogous programs of chemical safety are being pursued in directorates throughout the Laboratory.

Procurement of hazardous chemicals is effectively controlled by stipulations in the LLNL *Procurement Manual,* the *LLNL Health & Safety Manual,* and the *LLNL Hazards Control Manua/.* These stipulations require that experts in the Hazards Control Department review and approve (if indicated) requests for procurement of special hazardous chemicals (such as carcinogens and toxic gases). Evidence was provided that the system is functioning satisfactorily.

The system for management review and authorization of operations involving the use of chemicals in Laboratory facilities is defined by requirements stipulated in the *LLNL Health & Safety Manual* and in the FSP for each facility. This system is an important element of the Laboratory hazards analysis program. In the C&MS Directorate, a project work plan (PWP) is submitted for any new or modified operation involving a use of chemicals that transcends prior laboratory experience. The PWP may indicate the need for a special OSP to ensure chemical safety of the new or modified operation. However, a PWP is not always required for new or modified operations; moreover, those situations for which exceptions are permitted to the requirement for submitting a PWP are not clearly articulated in a written protocol. Also, there is not 100 percent conformance by the experimenters to the guidelines specified in the FSP, even in cases for which a PWP is required. In addition, accident analyses are not provided in the existing safety documentation for the facilities included in the LLNL self-evaluation. These weaknesses in the Laboratory hazards analysis program are considered a vulnerability. A more detailed discussion of this vulnerability is provided in Section 3.2 and in Attachment 2 of this appendix.

LLNL is in the process of implementing a computerized ChemTrack system to maintain a record of the chemical inventory in each work area (i.e., laboratories, shops, and chemical storage facilities). Although the self-evaluation implied that ChemTrack is a real-time system, it is not. Nonetheless, this lack of a real-time feature in ChemTrack does not seriously detract from its fundamental benefit of providing management with vital information on chemical inventories, A new system, the Facility Management Information System (FAMIS), is being developed by the C&MS Directorate. When operational, FAMIS will allow a graphic display of

every laboratory and facility within the Directorate and will have the potential for extending the capability sitewide. Linking FAMIS with ChemTrack would enable an almost instant display of the ChemTrack inventory data at any selected geographical location at LLNL, and would thus provide valuable safety-related information to anyone coping with an emergency situation at that location. The completion of the development and implementation of FAMIS is being delayed by lack of funding. Development and implementation of these two management systems is considered commendable.

Another commendable practice is the continuing supporl given by LLNL to the Albuquerque Operations Office (AL) Toxic Materials Coordinating Committee (TMaCC). The TMaCC has been supporting the DOE Office of Defense Programs activities since 1975. LLNL operations management and industrial hygiene personnel have actively supported the initiatives of the committee during this nearly 20-year period. Personnel from LLNL have chaired the committee and have provided valuable support in the identification and control of toxic chemicals used throughout the DOE weapons complex. Contributions made by LLNL are recognized as a model for support of toxic material control initiatives applicable throughout DOE.

2.4 **Human Resource Programs**

The review of human resource programs focused on examining of staffing levels, chemical safety training program design and implementation, and the depth of employee concerns and assistance programs. LLNL and C&MS Directorate policy documents related to chemical safety programs at the Laboratory were also reviewed. Training documents were examined to determine the strategy for implementing the policy. Implementation of policy and program content was addressed with C&MS management and staff. In addition, program managers outside the C&MS Directorate using the B-222 Complex, supervisors having personnel matrixed to the B-222 Complex, and the LLNL Training Manager were interviewed.

C&MS staffing levels are sufficient to ensure that personnel do not work excessive hours and have sufficient time to address chemical safety considerations. In addition, a variety of health and safety professionals are available to support the LLNL directorates through ES&H teams. The teams consist of professionals from fire protection, industrial hygiene, industrial safety, environmental protection, health physics, pressure safety, and criticality safety. The team supporting C&MS has sufficient resources to oversee routine and nonroutine chemical activities and provide technical assistance on a timely basis. ES&H Team 3 has a technician assigned full time to the B-222 Complex.

The C&MS Directorate has implemented an Ombudsman Program to provide a resource outside the line organization to address employee concerns. Employees consider the program to be effective and useful, and employee confidentiality is maintained. The Deputy Associate Director for Operations in the C&MS Directorate is the management contact point for the program. Also, C&MS has implemented the DOE Occupational Safety and Health Protection Program in conjunction with the LLNL Sample Tracking and Reporting Program. Through the Sample Tracking and Reporting Program, an employee can request that an evaluation of any perceived hazard be performed by the Hazards Control Department by simply submitting the Hazard Evaluation Request Form or by requesting that the department complete a Hazard Assessment Control Form (see Section 2.1).

The C&MS Directorate established the Office of Deputy Associate Director for Assurances to perform oversight and assessment of the adherence to ES&H policies, procedures, and quality assessment requirements of LLNL and the C&MS Directorate. During February 1993, that office conducted a comprehensive self-assessment of training and qualification programs within the C&MS Directorate. In August 1993, a corrective action plan addressing the findings of the training self-assessment was prepared. The corrective actions identified by the C&MS Directorate have not been completed.

Employee training is the collective responsibility of the individual and the immediate supervisor within the individual's home group, the supervisor of the facility in which the individual works, and the supervisor of the program in which the individual participates. Extensive communication is required to establish and maintain a cohesive and effective safety training function in the LLNL matrix organization. Supervisors are responsible for ensuring that individuals receive the requisite training of their respective organizations. The designation of safety training requirements, the emphasis on completion of the training, and the accuracy and retention of records vary greatly between organizations. Considerable variation in the understanding of training requirements also exists.

The LLNL training course that addresses the safe handling of cryogenic liquids does not reflect the personal protective equipment (PPE) requirements of the LLNL *Healfh & Safety Manua/.* Hence, personnel following the guidance provided in the training class are not necessarily using the appropriate PPE and are not conforming to the safety requirements of the LLAU *Hea/th & Safety Manual.*

A chemical vulnerability exists for the B-222 Complex in the area of chemical safety training. LLNL personnel are entering potentially hazardous work environments without the benefit of training that correctly addresses the chemical hazards associated with the work environment. In addition, the work environment of some employees has not been evaluated to determine whether facility-specific chemical hazards training is warranted. A more detailed discussion of this vulnerability is provided in Section 3.2 and in Attachment 2 of this appendix.

2.5 **Emergency Management Program**

Provisions for emergency response at LLNL include emergency plans and procedures, hazards analysis, emergency equipment, responder training, drills and exercises, and coordination between the Laboratory and the community.

The LLNL Draft *Emergency Plan* **7993** is the central document that establishes and describes the Laboratory's overall emergency management program. Facility -level procedures for emergency response are provided in the FSPS and the Self-Help Plans. Responder-specific procedures are provided in additional documents (e.g., LLNL *Fire Department Operations Manua/,* Procedure 1612, "Hazardous Materials Response Plan").

The Laboratory has a system in place to respond to an emergency involving hazardous materials. In the event of an emergency at an LLNL facility, a "91 1" telephone call is made, facility occupants evacuate to a predesignated assembly point, and the LLNL Fire Department provides primary emergency response. A "911" telephone call to the LLN L 24-hour-a-day emergency dispatcher would initiate fire department response. Fire department resources

include three onshift companies (i.e., four persons each with one company located at Site 300), a duty chief officer, firefighting and emergency medical vehicles/equipment, and a dedicated hazardous materials response vehicle. Firefighters are trained in hazardous materials response (at the “specialist” or “technician” level in each company), and as emergency medical technicians. The onshift captains are trained as incident commanders. The onshift captain at the scene assumes the role of incident commander until relieved by a chief officer. Technical assistance is provided to the incident commander by personnel from the Hazards Control and Environmental Protection Departments with expertise in such disciplines as health physics, industrial hygiene, industrial safety, explosives safety, and environmental protection. If additional fire, hazardous materials, and/or emergency medical response resources are needed, firefighters and vehicles from surrounding communities are provided in accordance with the community mutual aid agreements.

The close working relationship that has been established between the LLNL Fire Department and the fire departments of surrounding communities is commendable. The extent of coordination and cooperation is exemplified by joint participation in training and drills, monthly meetings with community officials, successful public relations activities, the automatic mutual aid agreement with the city of Livermore, the absence of funding issues, and use of the LLNL dedicated hazardous materials vehicle for offsite emergencies.

Conversely, implementation of the UM *Drafl Emergency Plan 1993* in the event of a sitewide hazardous materials emergency is not certain because the formal procedures to implement the plan have yet to be developed. These procedures (i.e., the Emergency Plan Implementing Procedures) are to identify the detailed actions necessary to achieve an integrated, sitewide emergency response as set forth in the plan. The Laboratory is in the process of, but has yet to complete, development of these procedures. Absence of these procedures represents an LLNL sitewide vulnerability. A more detailed discussion of this vulnerability is provided in Section 3.2 and in Attachment 2 of this appendix.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker health and safety. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged weaknesses, and/or unacknowledged weaknesses in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future based on degradation of systems and chemicals or through expected actions.

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in either of the following:

- The death of or serious physical harm[2] to a worker or a member of the public or continuous exposure a worker or member of the public to levels of hazardous chemicals above hazardous limits; or

- Environmental impacts resulting from the release of hazardous chemicals above established limits.

The prioritization of chemical safety vulnerabilities is based on the professional judgment of team members concerning the immediacy of the potential consequences posed by each vulnerability and on the potential severity of those consequences. The first step in the prioritization process was to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories have been established for the timeframe within which the consequences are expected to occur:

- Immediate — Any chemical safety vulnerability that could result in immediate consequences.

- Short-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Medium-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–1 O-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Lena-Term — Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring in the timeframe of more than 10 years as a result of

[2] Serious physical harm is defined as impairment of the **body, leaving part of the body functionally useless or substantially reducing efficiency on or off the job.**

chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category are further prioritized, based on the severity of the potential consequences, as "high," "medium," or "low" priority. Consequences of high severity would cause death or irreversible injury or illness to workers or the public, or would cause environmental damage that is irreversible or very costly to remediate. Low-severity consequences would be reversible injuries, illness, or environmental damage.

3.2 **Chemical Safety Vulnerabilities at Lawrence Livermore National Laboratory**

Four vulnerabilities were identified during the conduct of this review, all having short-term consequences.

CSVR-LLNL-FM-OI: Limited Strategic Planning for the Disposition of Aging/Inactive Facilities That May Contain Residual Amounts of Hazardous or Mixed Waste.

Building 222 has been identified as having significant maintenance problems due to the poor condition of the roof structure and the amount and deteriorated condition of the heating, ventilating, and air-conditioning equipment on the roof. The building is 40 years old and is at the end of its useful life. LLNL has substantially completed (i.e., 90 percent) a conceptual design review that documents a program for eventual D&D of the facility. This review examined three options (i.e., leave the building inactive, demolish the building, or refurbish the building for office use). The report recommended building demolition commencing in fiscal year 1995. The budgetary resources to execute any of the options examined in the conceptual design review have not been allocated.

Although this facility is operated by LLNL for the DOE Office of Defense Programs (DP), responsibility for the structure may transfer to the DOE Office of Environmental Management (EM). No decision has been made on this matter. If EM administers the D&D program after Building 222 is vacated, D&D is expected to have a low priority for funding because of the potential risk when compared with other EM-administered facilities. Currently, there are insufficient funds to implement an effective maintenance program adequately as evidenced by the significant backlog of maintenance jobs. The possibility exists that the facility will be vacated and remain so for a long time. Limiting the dispersal of the small amounts of unknown residual hazardous constituents of the facility without sufficient funds will be difficult. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

CSVR-LLNL-MO-O1: Weaknesses in the Hazards Analysis Program.

A review of the LLNL hazards analysis program revealed two weaknesses: (1) the lack of explicit definition for the conditions under which the preparation of a project work plan (a requirement of the C&MS Directorate) is required to address new or modified operations involving the use of chemicals, plus the lack of 100-percent response from experimenters in conformance to the guidelines in preparing project work plans, and (2) the absence of accident analyses in the existing safety documentation for the facilities included in the LLNL

self-evaluation. Either of these weaknesses could lead to a chemical safety vulnerability in the operation of LLNL facilities.

An incident could occur as a result of the absence of an assessment of chemical safety problems that could be introduced by a new or modified process, or by failure to consider the risks of an unaddressed credible accident (e.g., an unreviewed safety question). The potential consequences of an incident that could derive from the cited weaknesses in the LLNL hazards analysis program are personnel injury or illness and property damage. These conditions and circumstances represent a low-priority vulnerability with a potential for short-term consequences.

CSVR-LLNL-EP-O1: Absence of Emergency Plan Implementing Procedures (EPIPs) for Integrated LLNL Response to a Sitewide Hazardous Materials Emergency.

Although facility-specific and responder-specific procedures for emergency response activities (e.g., procedures for evacuation of individual facilities and for fire department response to hazardous materials spills) are currently in place at LLNL, the formal procedures that provide for an integrated, sitewide response to a hazardous materials emergency, the Emergency Plan Implementing Procedures (EPIPs), have yet to be developed. The EPIPs are identified **in the LLNL** *Draft Emergency P/an 1993* **as the** primary working documents to be followed for sitewide emergency response. The absence of these EPIPs precludes certainty that the Laboratory would implement an integrated overall response to a hazardous materials emergency.

The purpose of the plan is to describe the LLNL emergency management system, a system designed to respond to and mitigate consequences of emergencies that could threaten LLNL workers, the public, national security, or the environment. The plan is the source document for other site documents pertaining to emergency management. The plan (1) delineates LLNL emergency response policies, procedures, and commitments; (2) describes how the integrated matrix system, common to LLNL operations, functions during an emergency; and (3) specifies authorities and responsibilities within LLNL concerning the management of and recovery from emergencies. The plan describes the organizational elements, interfaces, authorities, responsibilities, resources, and predetermined actions to be taken in response to an emergency. It describes the activities necessary to ensure the readiness of the emergency response organization and sets forth the provisions for the rapid mobilization and expansion of the response commensurate with the magnitude of the emergency. The working procedures to be followed to implement the plan during an actual emergency are contained in the EPIPs.

The EPIPs, to be prepared in cooperation with the cognizant LLNL organizations having emergency response responsibilities, are intended to describe the actions necessary to implement the commitments and responsibilities set forth in the plan. These procedures are to be implemented by the sitewide LLNL emergency response organization during an emergency and are intended to be position-specific and formatted to include checklists that provide step-by-step, predetermined response actions.

Other LLNL documents pertaining to emergency management include facility-specific and responder-specific information and response procedures. For example, the FSP contains detailed safety and emergency procedures for a specific facility. LLNL Self-Help Plans

provide facility-specific procedures for evacuation and assembly of facility occupants. The Run Card System provides firefighter first responders with facility-specific information essential for the initial mitigation of emergencies. The LLNL *Fire Department Operations Manual,* Procedure 1612, "Hazardous Materials Response Plan," provides the procedures for response to spills of hazardous materials. The absence of EPIPs could result in a sitewide hazardous materials emergency and represents a low-priority vulnerability with a potential for short-term consequences.

CSVR-LLNL-MT-O1: Personnel Entry Into Hazardous Work Environments **Without Benefit of Chemical Safety Training.**

A chemical vulnerability exists at the B-222 Complex in the area of chemical safety and hazards identification training. LLNL personnel are entering potentially hazardous work environments without the benefit of training that correctly addresses the chemical hazards associated with the work environment. In addition, the work environment of some employees has not been evaluated to determine whether facility-specific chemical hazards training is warranted,

The chemical vulnerability in training presents a threat to worker health and safety that could result in the exposure of personnel to chemical agents above acceptable concentrations. Individuals unaware of the proper procedures, safety precautions, and chemical hazards associated with the chemicals in a laboratory could, through inadvertent use or spill of a chemical, unnecessarily expose themselves or co-workers to excessive levels of corrosive, reactive, carcinogenic, or toxic materials. These conditions and circumstances represent a low-priority vulnerability with a potential for short-term consequences.

Attachment 1

TEAM COMPOSITION

Area of Responsibility	Name/Organization
Team Leader	Leonard M. Lojek Office of Performance Assessment U.S. Department of Energy
Management/Operations	Leon H. Meyer The LHM Corporation
Management/Training	Thomas L. Van Witbeck TOMA Enterprises
Chemical Process Safety	Harold J. Groh HJG, Inc.
Industrial Hygiene	Michael C. Garcia Albuquerque Operations Office U.S. Department of Energy
Environmental Protection	Clifford H. Summers Arthur D. Little, Inc.
Maintenance	David M. Johnson Program Management, Inc.
Emergency Management	Thomas A. Kevern Program Management, Inc.
Site Liaison	Charles A. Taylor Livermore Site Office U.S. Department of Energy
Chief Coordinator	Mary E. Meadows Environmental Management Associates
Coordinator-In-Training	Norma B. Cameron Office of Performance Assessment U.S. Department of Energy
Coordinator-In-Training	Lisa L. Alexander Program Management, Inc.
Technical Editor	Robert F. McCallum McCallum-Tumer, Inc.

ATTACHMENT 2

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM **DATE: April 27,1994**

Site/Facility: LLNL

Vulnerability Number: CSVR-LLNL-FM-O1

Functional Area(s): Facility Physical Condition, Operational Control and Management Systems

1. Brief Description of Vulnerability.

Limited strategic planning for the disposition of aging/inactive facilities that may contain residual amounts of hazardous or mixed waste

2. Summary of Vulnerability.

Building 222 Chemistry Laboratory is approximately 40 years old, and the roof and some mechanical equipment are deteriorating. Extensive maintenance is required to bring the facility up to current accepted standards. The building is tentatively scheduled to undergo decontamination and decommissioning (D&D) in less than 5 years, but activities such as characterization of suspected hazardous or mixed waste are not complete. Planning for moving the current occupants to other facilities is not complete, and funding is uncertain. Program responsibility for accomplishing the D&D of the facility has not been formally established between either the DOE Office of Defense Programs (DP) or the DOE Office of Environmental Management (EM), and the facility could potentially remain vacant for a long period of time after current operations are suspended.

3. Basis.

a. Requirements: Multiple Federal and State environmental regulations.

b. Chemicals Involved: Multiple laboratory hazardous/toxic chemicals (e.g., heavy metals, organic chemicals, acids, radioactive materials), typically in small amounts and potential residual unknown mixed waste.

c. Relevant Self-Evaluation Data: The LLNL self-evaluation identified the leaking roof condition and characterized the condition of B-222 as poor.

d. Contributing Causes:

- The facility may be transitioned to EM-60 for D&D. It will probably be low on the priority list of funding for EM D&D projects.
- Present funding for building maintenance activities is inadequate as evidenced by a large ($7 million) backlog. Roof replacement costs are estimated at $15-$20 million. Funding requests for upkeep of the facility are routinely rejected by DP.

" Formal planning for final disposition of the facility is not complete. The new facility, which will house the present chemistry operations, is still under construction.

e Potential Consequences:

- Building 222 is at risk to remain vacant and unoccupied for a long period of time following completion of present operations. The contents of the building, which include asbestos and unknown residual amounts of mixed/hazardous waste, are vulnerable to dispersal/migration.
- Characterized as a medium-priority vulnerability with a potential for short-term consequences.

Site/Facility:	**Lawrence Livermore National Laboratory**
Vulnerability Number:	**CSVR-LLNL-FM-O1**
Functional Area(s):	**Facility Physical Condition, Operational Control and Management Systems**

4. Supporting Observations,

- **The condition of the roof has resulted in a number of leaks from rain and condensate. Repair activities of the mechanical roof-mounted systems are frequent and extensive in nature, resulting in excessive wear on the roofing system. Craft maintenance personnel operate safely, as long as strict administrative controls are followed.**

- **The site has not completed the formal Condition Assessment Survey and subsequent entry of data into the data base. This survey is used by DP to prioritize surveillance and maintenance funding for its operating facilities.**

- **LLNL has partially completed a conceptual design review that documents a program for eventual D&D of the facility. This review examined three options (i.e., leave the building inactive, demolish the building, or refurbish the building for office use). The report recommended building demolition commencing in fiscal year (FY) 95. This date could be delayed by up to 2–3 years. A request for D&D funding has been made for FY 98. DP has not approved this funding.**

- **A significant backlog of maintenance ($7 million) exists.**

- **Demolition of the facility may result in generation of mixed waste, but no characterization of the hazards associated with removal of this waste has been conducted.**

- **Planning activities related to D&D of B-222 are just beginning. Planning activities to complete the move to new facilities are partially complete. An LLNL task force for space and site planning has recently been established to identity and evaluate options when facility transitions occur.**

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 27, 1994

Site/Facility: Lawrence Livermore National Laboratoy

Vulnerability Number: CSVR-LLNL-MO-O1

Functional Area(s): Operational Control and Management Systems, Identification of Chemical Holdings

1. Brief Description of Vulnerability.

Weaknesses in the hazards analysis program

2. Summary of Vulnerability.

Weaknesses noted in elements of the hazards analysis program that could lead to a chemical safety vulnerability were (1) the lack of explicit definition for the conditions under which preparation of project work plans is required to address new or modified operations or equipment involving the use of chemicals plus the lack of total response of experimenters in conforming to the guidelines for submitting project work plans (when required) and (2) the absence of accident analyses.

3. Basis.

a. Requirements:

- DOE 5481.1 B, “Safety Analysis and Review System”
- SAN MD 5481.1A, “Safety Analysis and Review System”
- M-01 O, LLA/L *Health & Safety Manua/,* Chapter 2
- CMS-94-304, *ES&H Management Plan*
- *FSP-222,* “Facility Safety Procedure,” C&MS, Building 222 Complex
- FSP-235, “Facility Safety Procedure,” C&MS, Building 235 Complex
- UCI D 21416, *Safety Ana/ysis and Review of the Existing 825, 826, 827 Chemistry Facilities*

b. Chemicals Involved: All hazardous chemicals in inventory.

c, Relevant Self-Evaluation Data: The LLNL self-evaluation indicated that hazards analyses for the identified facilities are judged to be satisfactory and to present no chemical vulnerabilities.

d. Contributing Causes:

- Lack of implementation of stipulated hazards analysis requirements.
- Inadequate definition of protocol to be followed in implementing requirements.
- Lack of analyses of worst-case accidents.

e. Potential Consequences:

- Personnel injury or illness.
- Property damage,
- Characterized as low-priority vulnerability with a potential for short-term consequences.

3ite/Facility: Lawrence Livermore National Laboratory

Vulnerability Number CSVR-LLNL-MO-O1

Functional Area(s): Operational Control and Management Systems, Identification of Chemical Holdings

1. Supporting Observations.

Project Work Plans:

- The LLNL *Health & Safety Manual* (p. 2-1) states that the facility safety procedures (FSPS) authorize and provide controls for long-term activities and use of hazardous materials.
- **The** FSP for the B-222-229 Complex (p. 4) and B-235 (p. 5) lists "new operations or significant changes to existing operations" as *requiring* a C&MS Directorate Project Work Plan.
- The C&MS ES&H Management *Plan* (p. 5-1) states that ES&H issues must be evaluated for new facility or programmatic projects before commencing work and that this requirement is met through the use of the C&MS Directorate Project Work Plan.
- Discussions with C&MS Directorate management personnel, however, revealed that a project work plan is not always required for new operations or changes to existing operations; moreover, those situations for which exceptions are permitted to the requirement for submitting a project work plan are not clearly articulated in a written protocol (although Section B. 1.1 of FSP-222 does address operations that are authorized under the FSP and hence do not require a project work plan). Also, discussions with the C&MS Directorate Operations Manager indicated that response from experimenters has not been 100 percent, even in those cases for which a project work plan is required by the guidelines specified in the FSPS.
- This indicated lack of explicit definition for conditions under which a project work plan is required for new operations or significant changes to existing operations plus the lack of total response from experimenters in conforming to guidelines for preparing project work plans (when required) introduces an uncertainty in the procedure, which could lead to a chemical safety vulnerability.

Accident Analyses:

- Existing safety analysis documents for the B-222-229 Complex, B-235, and the B-825-827 Complex do not contain analyses of worst-case accidents and consequences and do not provide a quantitative estimate of risk from these facilities, LLNL plans to include accident analyses in preliminary hazards analyses and safety analysis reports (SARS) that are scheduled to be prepared for the B-222-229 Complex and B-235, Several SARS for facilities at Site 300 that are in the review or draft stage contain detailed accident scenarios and quantitative risk analyses. In addition, extensive accident analyses are summarized in DOE/El 5-0157, *Final Environmenta/ impact Statement and Environmenta/ impact Report for Continued Operation of Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore* (Appendix D), However, these analyses define bounding accident scenarios for the LLNL site and do not provide information to mitigate accidents in specific buildings within the scope of this review.
- Among the facilities reviewed, the B-222-229 Complex and B-235 present relatively low potential for chemical safety vulnerability. Activities in these facilities normally involve only small quantities of hazardous chemicals in research and development experiments; furthermore, training, engineering controls, and administrative controls are satisfactory to reduce risks. Buildings B-222, B-227, B-229, and B-235 are classified as "low" hazard, nonnuclear facilities; B-223, B-224, B-225, B-226, and B-228 are classified as "excluded" from requiring formal safety analyses. Buildings B-825, B-826, and B-827 are classified as "moderate" hazard, nonnuclear facilities, and present relatively greater risk than the B-222-229 complex and B-235 because of the processing of large quantities of high explosives.
- The absences of quantitative risk information from accident and analyses results in greater uncertainty in judging the adequacy of existing safety controls.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 27, 1994

Site/Facility: Lawrence Livermore National Laboratory

Vulnerability Number: CSVR-LLNL-EP-O1

Functional Area(s): Emergency Management Program

1. Brief Description of Vulnerability.

Absence of Emergency Plan Implementing Procedures (EPIPs) for integrated LLNL response to a sitewide hazardous materials emergency

2. Summary of Vulnerability.

The ***draft LLNL Emergency P/an 7993*** provides an overall description of the site's emergency management program and the response organization. As stated in the plan, the primary working documents to be followed to achieve an integrated, sitewide emergency response are the procedures contained in the EPIPs. At present, these EPIPs are not in place.

3, Basis.

a. Requirements:
- DOE 5500.3A, Paragraph 11d (2)
- UC RL-MA-1 13311, ***LLNL*** **Emergency** ***P/an 7993*** (draft), Section 1.1

b. Chemicals Involved: All hazardous materials at LLNL,

c. Relevant Self-Evaluation Data: LLNL self-evaluation (i.e., B-222-229 Complex, p. 21; B-235, p. 17; and B-825-827 Complex, p. 17) states that the working procedures to be followed during an actual emergency are contained in the EPIPs. The self-evaluation states that the adequacy of the program is considered "satisfactory."

d. Contributing Causes:
- Lack of implementation of identified requirements.
- Sufficient resources have not been applied to the task of procedure development. At present, one experienced contract individual on a part-time basis is developing these procedures.

e. Potential Consequences:
- Implementation of the sitewide emergency plan for response to an actual emergency is not certain without procedures.
- LLNL managerial emergency response would likely be accomplished on an ad hoc basis.
- Reviewed facilities do not appear to contain source terms sufficient to result in an emergency with impact beyond the respective facility.
- Characterized as a low-priority vulnerability with a potential for short-term consequences.

Site/Facility:	**Lawrence Livermore National Laboratory**
Vulnerability Number:	**CSVR-LLNL-EP-01**
Functional Area(s):	**Emergency Management Program**

4. Supporting Observations.

- DOE 5500.3A **requires the use of procedures to implement emergency plans.**
- **The draft LLNL Emergency Plan** 7993 **states that procedures termed EPIPs are the mechanism for implementing the plan.**
- **The LLNL self-evaluation states that the procedures to be followed during an actual sitewide emergency are contained in the EPIPs.**
- Review **of available LLNL documentation identified facility-specific and responder-specific emergency response plans and procedures, but no sitewide EPIPs.**
- **Interviews with the cognizant LLNL point-of-contact confirmed that EPIPs are currently being developed.**

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: April 27, 1994

Site/Facility: Lawrence Livermore National Laboratory

Vulnerability Number: CSVR-LLNL-MT-O1

Functional Area(s): Human Resource Programs

1. Brief Description of Vulnerability.

Personnel entry into hazardous work environments without benefit of chemical safety training

2. Summary of Vulnerability.

Personnel are entering potentially hazardous work environments without the benefit of training that correctly addresses the associated chemical hazards. In addition, the work environment of some employees has not been evaluated to determine if facility-specific chemical hazards training is warranted.

3. Basis.

a. Requirements:
- LLNL ***Hea/th & Safety Manua/,*** Supplement 22.01, "Safe Handling of Cryogens"
- "Facility Safety Procedure 222"
- ***C&MS Training*** Program, Appendix B, "C&MS Training Requirements"
- Chemical Safety Training Course, HS4240
- Pressure Safety Orientation Training Course, HS503 (currently HS5030)
- Laboratory Safety Training Course, HS4246
- 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"
- . 29 CFR 1910.1200, "Hazard Communication"
- 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories"

b. Chemicals Involved: Cryogenic liquids and all hazardous chemicals in inventory

c. Relevant Self-Evaluation Data: **The LLNL self-evaluation considered the LLNL *Training Prograrn Manual*** and the Chemistry & Materials Science Training Plan to be "satisfactory." "Training tracking" was considered to be "good."

d. Contributing Causes:
- The application of safety training requirements to specific job assignments, the emphasis placed on completion of the training, and the accuracy and retention of records vary greatly among organizations.
- The communication required to establish and maintain a cohesive and effective safety training function in the LLNL matrix organization is extensive. Currently, communications regarding work assignments, job location, and required safety training do not ensure that all matrixed personnel receive the proper safety training.
- Considerable variation in the understanding of the safety training requirements was noted.
- The LLNL training addressing the safe handling of cryogenic liquids does not reflect the personal protective equipment (PPE) requirements of the LLAIL ***Hea/th & Safefy Manual*** hence, personnel following the guidance provided in the training class are not necessarily using the appropriate PPE and are not conforming to the safety requirements.

e. Potential Consequences:
- Personnel injury,
- Property damage.
- Characterized as a low-priority vulnerability with a potential for short-term consequences.

Site/Facility: Lawrence Livermore National Laboratory

Vulnerability Number: CSVR-LLNL-MT-O1

Functional Area(s): Human Resource Programs

4. Supporting Observations.

- In a chemical laboratory area, an LLNL staff member was observed transferring cryogenic liquids without using proper PPE.
- An LLNL subcontractor was observed performing a bulk transfer of cryogenic liquids without the use of proper PPE.
- The curriculum for Pressure Safety Orientation (Course No. HS5030), which addresses cryogenic safety, states that glove, eye, and face protection are recommended but not required. The LLNL *Health & Safety Manual,* Supplement 22,01, states, "Using safety glasses with side shields is required at all times when cryogenic fluids are present . . . . If a cryogen is poured or if the fluid in an open container may bubble, a full face shield is required."
- An evaluation to determine the need for facility-specific training of the janitorial staff assigned to the B-222 Complex has not been performed and facility-specific training requirements have not been established for janitorial staff.
- A review of the training records of the B-222 Complex janitorial staff indicated there are no unique training requirements associated with an assignment involving work in a chemistry laboratory.
- A comparison of the C&MS Directorate roster of B-222 residents and the list of those personnel having completed the required chemical safety course (i.e., either Laboratory Safety, HS4246, or Chemical Safety, HS4240) revealed that six people, including several analytical chemists, have not completed either course. The Training Requirements and Qualifications data base was used as the source of information.
- A new LLNL employee, assigned to a chemical laboratory for several months, has been performing wet chemistry without the benefit of supervision. The employee has not attended the required chemical safety course.
- Employee training is the collective responsibility of the individual and the immediate supervisor within the individual's home group, the supervisor of the facility in which the individual works, and the supervisor of the program in which the individual participates. Each supervisor is responsible to ensure that each individual receives the requisite training required by his or her organization.

Attachment 3

SELECTED ACRONYMS

AEC	U.S. Atomic Energy Commission
AL	DOE Albuquerque Operations Office
CHEW	Chemical Exchange Warehouse
CSVR	Chemical Safety Vulnerability Review
C&MS	Chemistry and Materials Science (Directorate)
DOE	U.S. Department of Energy
DP	DOE Office of Defense Programs
D&D	Decontamination and Decommissioning
EAS	Environmental Analytical Sciences (Laboratory)
EH	DOE Office of Environment, Safety and Health
EM	DOE Office of Environmental Management
EPIP	Emergency Plan Implementing Procedure
ERDA	U.S. Energy Research and Development Administration
ES&H	Environment, Safety, and Health
FAMIS	Facility Management Information System
FSP	Facility Safety Procedure
LLNL	Lawrence Livermore National Laboratory
OSP	Operational Safety Procedure
PPE	Personal Protective Equipment
PWP	Project Work Plan
TMaCC	Toxic Materials Coordinating Committee
TSD	Treatment Storage and Disposal
Uc	University of California